higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

# MARKING GUIDELINE

## NATIONAL CERTIFICATE

## LOGIC SYSTEMS N4

**29 November 2022**

**This marking guideline consists of 8 pages.**

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## QUESTION 1

1.1 8 (1)

1.2 2 (1)

1.3 $10111101_2$

$01000010$ ✓

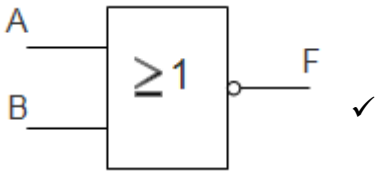
$+1$

$01000011$ ✓ (2)

1.4 $F = \overline{A+B}$ ✓

| A | B | F |
|---|---|---|
| 0 | 0 | 1 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 0 |

✓




✓ (3)

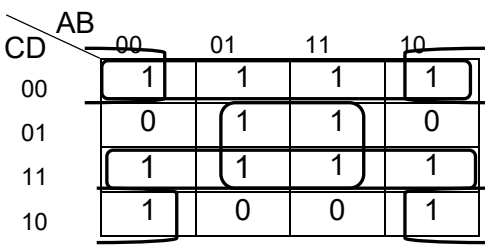
1.5 Logic 0 – 0 V
Logic 1 – 5 V (2)

1.6 A full adder has a carry input and a half adder has no carry input. (1)

1.7 1.7.1 A
1.7.2 1
1.7.3 $\overline{A \oplus B}$ ✓
1.7.4 0

(4 × 1) (4)

1.8 1.8.1

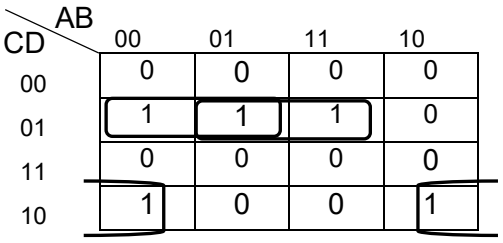



✓

$F = \overline{C}\overline{D} + CD + B\overline{D} + \overline{B}\overline{D}$

$= \overline{C \oplus D} + \overline{B \oplus D}$ ✓

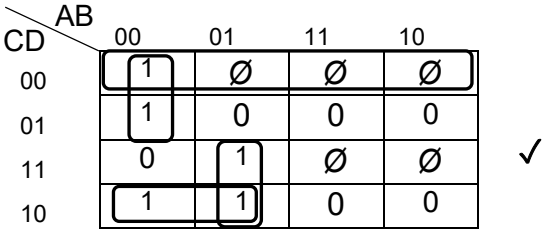
1.8.2




✓

$F = \overline{A}\,\overline{C}D + B\,\overline{C}\,\overline{D} + \overline{B}C\overline{D}$ ✓

1.8.3




✓

$F = \overline{C}\,\overline{D} + \overline{A}\,\overline{B}\,\overline{C} + \overline{A}BC + \overline{A}C\overline{D}$ ✓

(3 × 2) (6)
**[20]**

## QUESTION 2

2.1 2.1.1 $12,75_{10}$ - $F,D_{16}$

$12,75_{10} = 1100,11_2$ ✓½

$C,D_{16} = 1111,1101_2$ ✓½

$$\begin{array}{r} 1100,1100 \\ -1111,1101 \end{array}$$ ✓

$$\begin{array}{r} 1100,1100 \\ 0c + 0000,0010 \end{array}$$ ✓

$\square$ $1100,1110$ ✓

$= -0011,0001$ ✓

$-0011,0001_2 = -3,1_{16}$ ✓

2.1.2 $4C,A_{16} \times 2,4_8$

$4C,A_{16} = 01001100,1010_2$ ✓½

$2,4_8 = 010,100_2$ ✓½

$$\begin{array}{r} 1001100,101 \\ \times \quad 11,100 \\ \hline 100110010100 \quad ✓ \\ + \quad 10011001010000 \quad ✓ \\ \hline 10111111,100100 \quad ✓✓ \end{array}$$

$10111111,100100 = 277,44_8$ ✓

2.1.3 $731,2_8 \div 16,25_{10}$

$731,2_8 = 111011001,010_2$ ✓½

$16,25_{10} = 10000,01_2$ ✓½

$$\begin{array}{r} 11101,0001 \quad ✓ \\ 1000001 \overline{)11101100101,0000} \\ \underline{-1000001} \quad ✓ \\ 1101010 \\ \underline{-1000001} \quad ✓ \\ 1010011 \\ \underline{-1000001} \\ 1001001 \\ \underline{-1000001} \\ 10000000 \\ \underline{-1000001} \quad ✓ \\ 111111 \end{array}$$

$101,0001 = 5,0625_{10}$ ✓

$= 5\frac{1}{16}{}_{10}$

(3 × 6) (18)

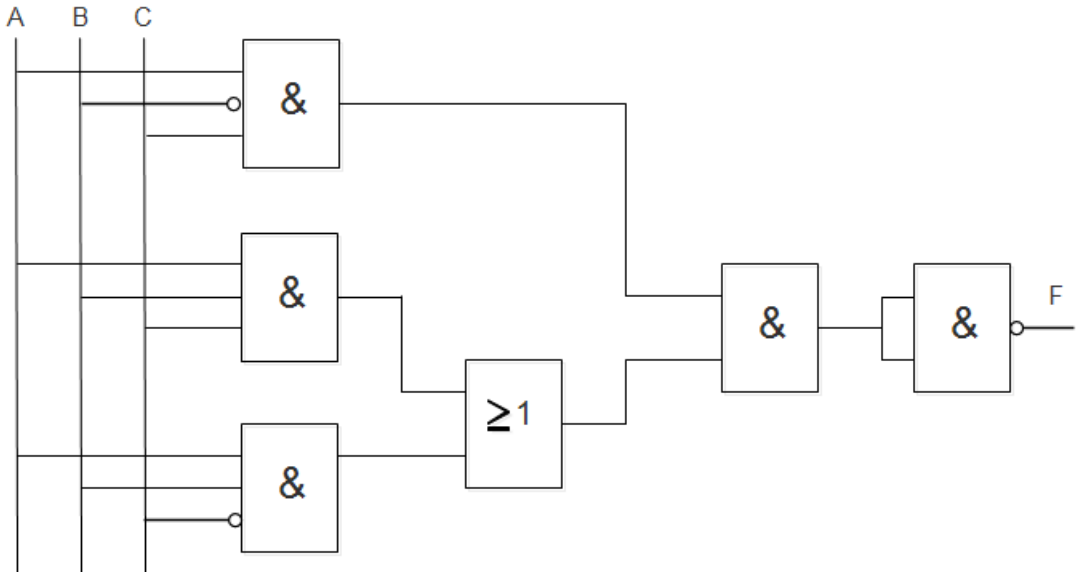
2.2 2.2.1 $123_{10}$
Binary $1111011_2$✓
Gray 1000110✓✓ (3)

2.2.2 $75_{10}$ (2)

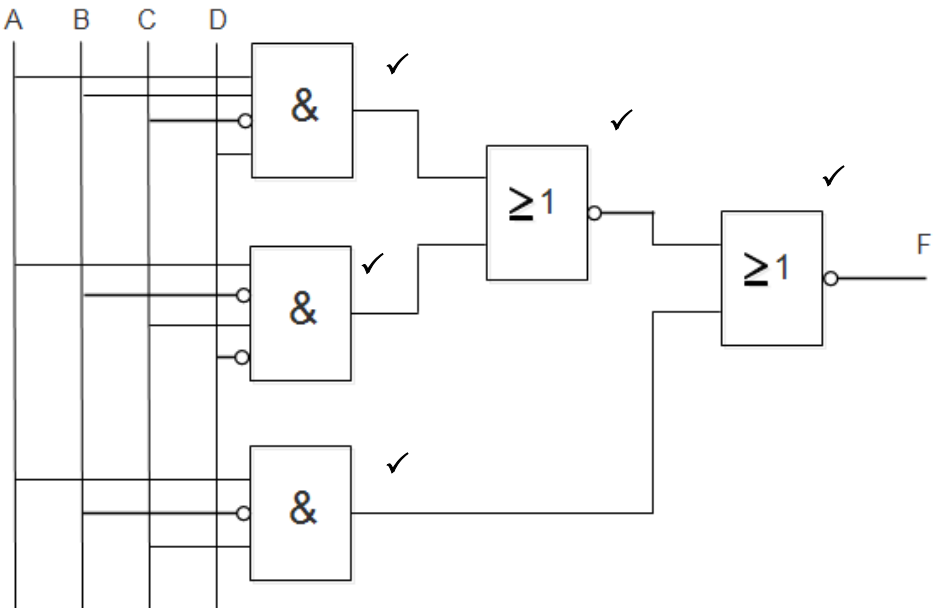
2.2.3 $50_{10}$ (2)
**[25]**

## QUESTION 3

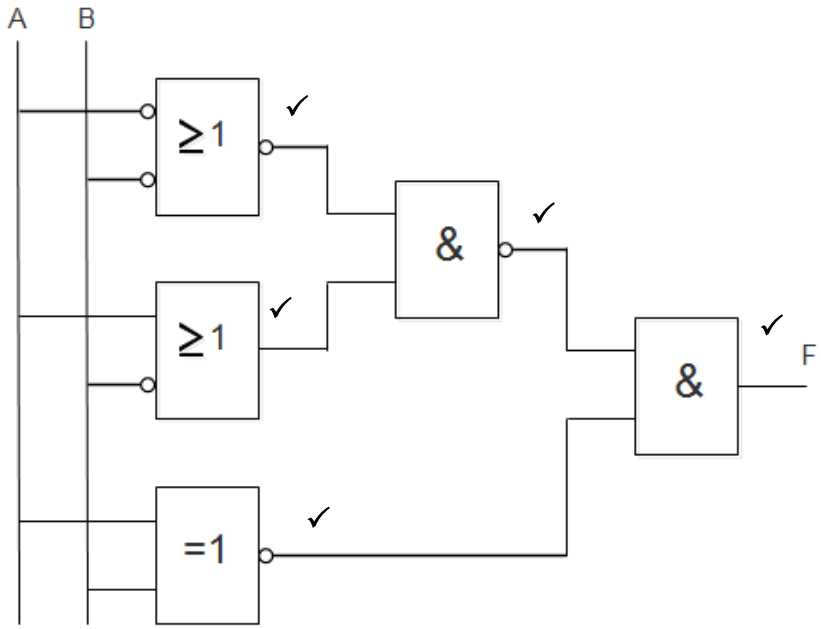
3.1 3.1.1




3.1.2



3.1.3




✓

(3 × 5) (15)

3.2 3.2.1

$$F = \overline{\overline{(A\bar{B}C + AB\bar{C})} \cdot \overline{(A\bar{B}\bar{C} + ABC)}}$$

$= A\bar{B}C + AB\bar{C} + A\bar{B}\bar{C} + ABC$ ✓

$= A\bar{B} + AB$ ✓

$= A(\bar{B} + B)$ ✓

$= A$ ✓ (4)

3.2.2

$$F = \overline{\overline{(A + \bar{B} + \bar{C})(\bar{A} + C)} \cdot \overline{(A + B)}}$$

$= (A + \bar{B} + \bar{C})(\bar{A} + C) + (A + B)$ ✓

$= A\bar{B} + \bar{A}\bar{C} + AC + \bar{B}C + A + B$ ✓

$= A(\bar{B} + C + 1) + \bar{A}\bar{C} + \bar{B}C + B$ ✓

$= A + \bar{A}\bar{C} + B + C$ ✓

$= A + \bar{C} + B + C$ ✓

$= A + B + 1$

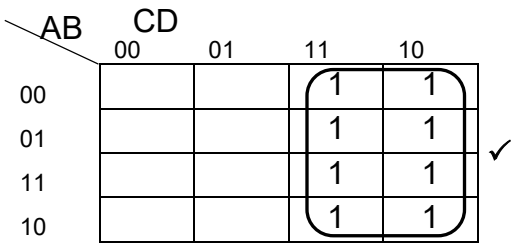
$= 1$ ✓ (6)

**[25]**

**QUESTION 4**

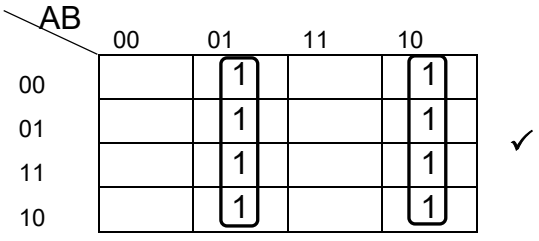
| Inputs (8421 BCD) | | | | Outputs (GRAY) | | | |
|---|---|---|---|---|---|---|---|
| **A** | **B** | **C** | **D** | **W** | **X** | **Y** | **Z** |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |
| 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |
| 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 |
| 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| 1 | 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |
| 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| 1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 |
| 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |
| 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 |
| | | | | ✓ | ✓ | ✓ | ✓ |

Learner must show Karnaugh map and correct simplification for 1 mark.
Award ½ mark if Karnaugh map is correct but simplification is incorrect.



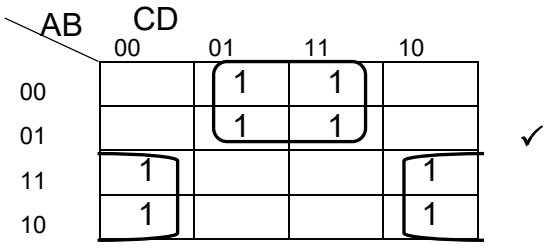

✓

$W = A$ ✓




✓

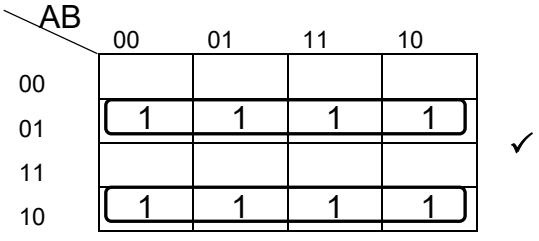
$X = \overline{A}B + A\overline{B}$ ✓ $= A \oplus B$ ✓




✓

$Y = B\overline{C} + \overline{B}C$ ✓

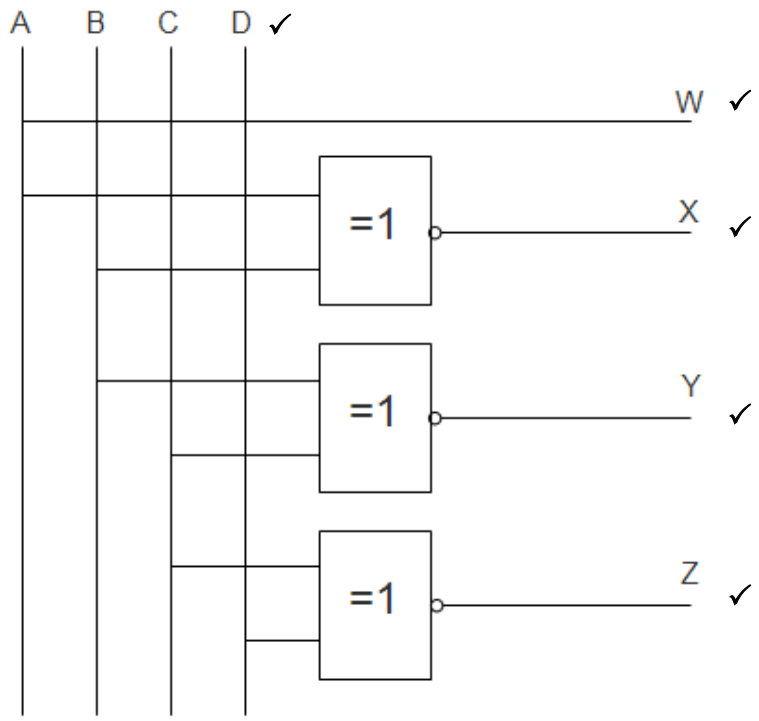
$= B \oplus C$ ✓




✓

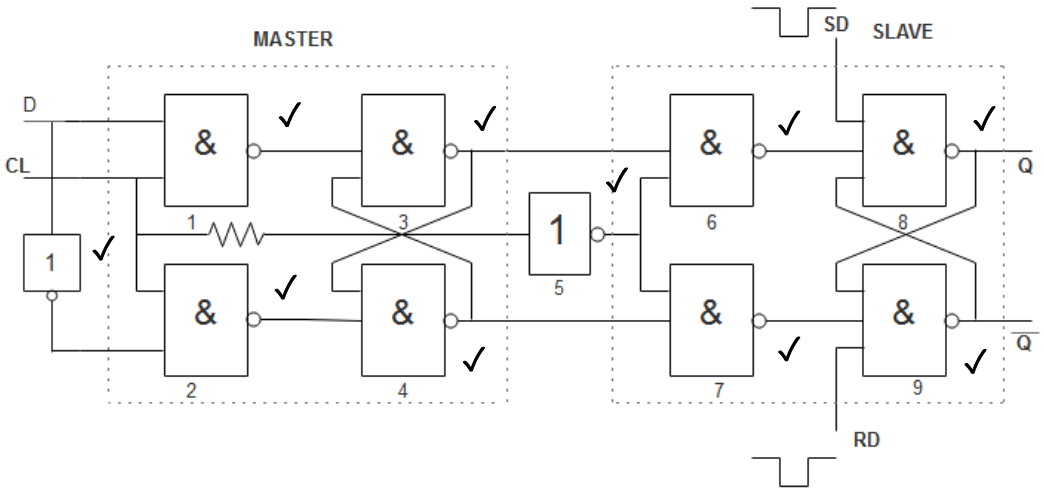
$Z = \overline{C}D + C\overline{D}$ ✓

$= C \oplus D$ ✓




**[20]**

## QUESTION 5




**[10]**

**TOTAL: 100**

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